

A Reinforced Concrete Tie Frame for Rail Joints

by Otto Wiedebusch

Der Verkehr, Vol 10, Oct 51, Mo per, (German)

STAT

A REINFORCED CONCRETE FRAME TIE FOR RAIL JOINTS

Otto Wiedebusch

Rail joints have always been a bothersome problem in track maintenance. Under the rolling weight of vehicles, the movement from the loaded to the unloaded rail end is always accompanied by a "step effect" as the result of hogging of the loaded rail. These "steps" cause the well known hammering and banging of the wheels which in its own turn causes excessive wear and tear on all track parts at the rail joints. Loose ties, chewed up fish plates and premature wearing out of fastenings are the results. The rail joint is the weakest part of track construction. [Note: German railways have simultaneous rail joints rather than the alternate joints used on American railroads.]

For many years the best experts have been trying to overcome or at least reach a partial solution of this problem by suggestions for improvement and by experimenting. From the original supported joint, a simple fish-plate connection on a single tie, a change was made to the so-called suspended joint. In order to reduce the hogging and with it the step effect there were tried out and put into application angle fish plates, double angle fish plates (Z-bars), impact fish plates (splice bars), foot clamps, scarfed and splayed joints, etc. These were intended to produce as rigid as possible a connection between the rail ends and to transfer the load from one rail to the other. All these measures did indeed bring improvements, but results were not entirely satisfactory. Finally the supported joint on a wide or coupled tie was adopted and is now in

general use. This most recent rail-joint arrangement is in fact a definite advance. But it is still not the definite solution to the difficult problem, since the double ties are difficult to tamp and are also difficult to hold in place under the impact of heavy mechanical forces. It is therefore necessary that experts -- men of experience and intelligence -- continue to address themselves to the problem of improving the arrangement of rail joints.

I have therefore also worked on the problem for years and have thought through many aspects. It is most advantageous to reduce the number of rail joints to the minimum by introducing the long rail type of construction. But for reasons of operating safety -- to avoid warping of tracks and rail breakage -- and because of the difficulties in changing rails or rail ends, there is a practical limit in this direction. On open lines rail lengths of more than 60 meters should be avoided. I was particularly challenged by the progressive development and actual application of the reinforced-concrete-tie type of track construction. Precisely with this type of construction the arrangement of rail joints is especially difficult and requires particular consideration. Since the manufacture and installation of special wide ties in reinforced concrete are difficult, the use of the suspended joint with normal ties and with reinforced fish plates and/or foot clamps was prescribed in connection with reinforced-concrete-tie construction, or else wooden coupled ties were laid between the concrete ties at the rail joints. Both arrangements are to be rejected for the reasons indicated.

After much consideration, and following a suggestion of the retired Reichsbahn Director P. Abrahams Der Eisenbahnbau (Railway Construction) 1949 No II/ finally decided to construct and try out a tie frame of reinforced concrete for the rail joints in reinforced-concrete-tie track construction. The design of this frame was carried out in collective work with Colleague Werner in Grossenhain and is illustrated in the accompanying diagrams.

The tie frame for rail joints consists of two special transverse ties of high pressure concrete, with 50 centimeters space between them. These ties are connected by two short ties under and parallel with the rails, the entire arrangement being held in the form of a rigid frame by bolts equipped with turn-buckles. The rail ends are fastened to the transverse and parallel ties by ribbed sole plates embedded in the concrete, so that each rail end is secured twice with only a short distance between the fastenings. The rail ends are connected to each other with normal flat fish plates. By this multiple close fastening of the rail ends and reduction of leverage a reduction of the bending force applied to the fishplate is secured and hogging or "step effect" is almost entirely eliminated. The distribution of thrust is more favorable due to the increased surface to which thrust is applied, and the thrust of the ties against the roadbed is correspondingly less.

In addition to the static improvement of the rail joints, the new arrangement simplifies and makes more efficient the work

of laying and maintaining track. The frame is assembled at the point of use from individual parts which are not too heavy. The two outside ties of the frame are, like all other transverse ties, laid along the gauging rails according to the standard distance between ties. In the <sup>c</sup>somewhat greater space between these two particular ties, the two short ties running parallel with the rails are installed. On the roadbed, which has already been graded to the right height and tamped solid, the four ties are then fastened into a solid frame with two turnbuckles alongside each of the lengthways ties. The weight of the frame and the possibility of tamping around all sides of the ties or filling up around it with shovels guarantee a good solid support for the joint. This results in reducing wear and tear on the rails and fastenings and cutting maintenance costs.

The outside transverse ties in the frame are identical with other transverse ties except for the places where they are fastened to the lengthways ties. They may be made of wire reinforced or high pressure concrete. The lengthways ties are on the other hand made of high pressure concrete with two screw bolts each running through them. These bolts are screwed tight after the ties have been cast and the heads and nuts are then covered with tamped-in concrete. The ribbed sole plates are, like those of the transverse ties, to be cast right into the lengthways ties ready for use.

The greater lateral rigidity provided by the use of tie frames prevents the bending outwards of the rail joints on curved tracks.

Even if the number of joints is greatly reduced by welding the rails together to a length of 60 meters, the use of tie frames for joints is a measurable step forwards towards the improvement of track joints, elimination of danger points and particularly the reduction of current maintenance costs.